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ASTROMETRIC OBSERVATIONS OF COMETS AND ASTEROIDS  
AND SUBSEQUENT ORBITAL INVESTIGATIONS

Grant NGR 09-015-212

Semiannual Progress Report No. 16

For the period May 1 to October 31, 1981

Principal Investigators

Dr. Richard E. McCrosky

Dr. Brian G. Marsden

November 1981



Prepared for

National Aeronautics and Space Administration  
Washington, D. C. 20546

Smithsonian Institution  
Astrophysical Observatory  
Cambridge, Massachusetts 02138

The Smithsonian Astrophysical Observatory  
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ASTROMETRIC OBSERVATIONS OF COMETS AND ASTEROIDS  
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Semiannual Progress Report No. 16

1. Personnel

R. E. McCrosky, Principal Investigator	No cost
B. G. Marsden, Coinvestigator	No cost
C. M. Bardwell, Data Reduction	No cost
G. Schwartz, Observer	No cost
D. W. E. Green, Observer and Measurer	No cost
C.-Y. Shao, Data Reduction and Observer	Full time

2. Observing Program

The 155-cm reflector was used for observations of comets and minor planets on 50 nights during the semester. Of the total of 248 observations, 42 referred to comets, 78 to numbered minor planets and 128 to unnumbered minor planets. The record number of accurate positions measured and reduced, 351, included 131 results from plates obtained previously. The outcome is summarized in the two tables: table 1 lists the 351 reductions, while table 2, gratifyingly small, lists the other 28 observations made during the semester that remain to be measured.

The observing was done by McCrosky, Shao, Schwartz and Green, the measurements and reductions by McCrosky, Shao and Green, the checking of the results and the selection of objects to be observed by Marsden and Bardwell. The

reductions were mainly done on the NOVA computer at the Agassiz observing station, the remaining computations on the VAX computer in Cambridge.

### 3. Results of Special Interest

Two short-period comets, P/Slaughter-Burnham (1981i) and P/Swift-Gehrels (1981j), were recovered. The announcement of these recoveries on consecutive IAU Circulars published five days apart provides an excellent illustration of the way such announcements should be made. In the past year or so, a number of observers with access to large telescopes have been attempting to pick up returning periodic comets (P/Halley included), but it has not always been clear that the results were successful. In the case of these two recent Agassiz recoveries the reports each included accurate measurements on as many as three nights, and there was thus absolutely no doubt that the claims were correct.

Other significant cometary observations included early post-recovery observations of P/Gehrels 2 (1981f) and P/Kearns-Kwee (1981h), a trio of useful observations of comet Bradfield (1980t) at great distance from the sun, and observations of the new periodic comets Bus (1981b) and Howell (1981k) that will help refine the periods of these objects.

In the area of minor planets, we have made the only observations of the unique object (2060) Chiron since shortly after its discovery four years ago, and we got on to the new Amor objects 1981 QA and 1981 QB soon after they were discovered.

Minor planets newly numbered entirely as a result of our observations

were: (2385) 1969 VW, (2400) 1972 KJ, (2427) 1978 YQ7, (2435) 4578 P-L, (2453) A921 SA, (2457) 1975 TU2, (2463) 1934 FF, (2475) 1972 TF2, (2482) 1980 CO (an Agassiz discovery), (2484) 1928 TK, (2485) 1932 BH, (2491) 1977 CB, (2493) 1978 XC (an Agassiz discovery) and (2495) 7071 P-L. (2395) 1977 FA was a new Agassiz discovery.

#### 4. Orbital Investigations

These have continued much as usual. Special computations were done with regard to the close approach of (2100) Ra-Shalom.

#### 5. Financial

No unusual expenditures occurred during this period. The program continues to operate within the original budget.

#### 6. Publications

Observations from Agassiz plates are included in the following publications issued during this half year: Minor Planet Circ. Nos. 5990-5991, 6069-6070, 6076, 6146-6147, 6162, 6225-6227, 6267-6269, 6350, 6410-6411, 6429-6431, 6435-6436 and 6457-6458; IAU Circ. Nos. 3621-3622, 3625, 3630, 3634, 3636 and 3645.

Orbital/and or ephemeris computations are on Minor Planet Circ. Nos. 6043-6055, 6061-6064, 6098-6099, 6101-6144, 6188-6190, 6193-6207, 6210-6220, 6285-6287, 6290-6301, 6307-6344, 6413-6414, 6416-6421, 6422-6424, 6463-6464 and 6468-6480; IAU Circ. Nos. 3601, 3606-3608, 3618, 3623, 3625, 3627, 3630, 3633-3636, 3638-3640 and 3645.

## Table 1

### Positional measurements

The successive columns give the object's designation (/ = comet, \* = new discovery), the UT date and time, the right ascension (in hours, minutes and seconds) and declination (in degrees, minutes and seconds) — equinox 1950.0.

/1974 II	1978 04	13.04659	05 13	50.36	+29 09	35.8
/1974 II	1978 11	01.30564	07 32	12.12	+27 00	54.8
/1976 III	1978 10	28.25569	04 47	07.57	+21 47	14.2
/1976 III	1981 01	06.32492	09 51	36.84	+25 34	20.4
/1976 III	1981 02	04.32880	09 33	57.49	+27 56	42.0
/1977 X	1978 08	09.30845	23 21	05.87	+01 02	07.1
/1977 X	1978 08	27.26255	22 56	36.21	-00 55	11.1
/1977 X	1978 09	05.25112	22 43	59.04	-01 58	54.9
/1977 X	1978 09	26.19975	22 16	44.79	-04 21	45.2
/1977 X	1978 10	31.02172	21 46	28.65	-07 08	50.0
/1977 X	1978 11	01.02858	21 45	55.40	-07 12	01.6
/1978 II	1978 09	27.23312	23 51	50.31	-18 08	09.2
/1978 XXIV	1978 03	07.39529	15 00	15.64	-09 33	13.5
/1979j	1981 03	12.33888	13 01	51.27	+07 03	57.6
/1979j	1981 04	08.29602	12 44	10.57	+09 43	08.3
/1979k	1980 12	05.36524	06 31	39.50	+19 14	48.8
/1980b	1981 02	10.36119	12 36	15.40	-01 58	13.3
/1980b	1981 05	23.13544	12 07	23.67	+01 15	28.0
/1980b	1981 06	06.14887	12 08	58.49	+01 00	14.0
/1980f	1980 09	09.15631	22 10	47.17	-07 43	57.8
/1980f	1981 01	31.01521	01 09	41.74	+03 13	46.3
/1980f	1981 03	02.01661	02 14	21.51	+09 13	08.2
/1980a	1981 03	02.11111	06 45	48.49	+44 06	27.9
/1980g	1981 04	04.06542	07 52	27.82	+40 53	08.2
/1980i	1981 01	30.98852	01 03	21.92	-04 46	18.0
/1980j	1981 01	31.99483	00 32	53.95	+07 36	40.4
/1980q	1981 04	10.35159	15 14	05.12	+22 31	52.9
/1980q	1981 06	03.15944	12 39	13.29	+06 47	03.4
/1980t	1981 06	29.29641	22 01	20.20	+16 31	17.2
/1980t	1981 07	07.29499	21 50	12.78	+16 04	52.8
/1980t	1981 07	28.25197	21 17	49.75	+13 45	37.0
/1980t	1981 08	27.16534	20 36	09.01	+08 26	08.8
/1980u	1980 10	09.08054	19 13	58.72	+37 45	02.8
/1980u	1980 10	27.97561	18 49	24.81	+35 50	04.7
/1981a	1981 06	06.09318	10 20	49.29	+20 39	30.5
/1981b	1981 03	11.20264	11 48	37.00	+00 35	16.8
/1981b	1981 05	23.08895	11 39	24.45	+03 24	06.6
/1981b	1981 05	24.11951	11 40	11.23	+03 20	03.2
/1981b	1981 06	06.11803	11 51	56.23	+02 14	36.8
/1981b	1981 06	27.09139	12 17	10.94	-00 16	34.0
/1981d	1981 05	03.19171	14 58	02.39	-05 37	02.8
/1981d	1981 05	08.26921	14 36	02.61	-04 43	18.7
/1981d	1981 05	27.13154	13 19	54.43	-01 44	23.2
/1981d	1981 06	24.09927	12 11	24.83	+00 04	26.3
/1981f	1981 08	01.27949	01 41	21.43	+14 48	10.3
/1981f	1981 06	27.35874	02 01	48.95	+16 10	44.4
/1981f	1981 09	25.34654	02 07	08.50	+15 36	00.6
/1981h	1981 08	01.31654	04 15	07.48	+29 20	35.6
/1981h	1981 08	29.35741	05 09	58.49	+31 46	24.0
/1981h	1981 09	25.37356	05 58	27.83	+33 08	12.9
/1981i	1981 07	09.28863	00 50	42.84	+06 32	07.5
/1981i	1981 07	10.30329	00 51	38.22	+06 40	55.2
/1981i	1981 07	28.29563	01 05	47.44	+09 07	19.6
/1981i	1981 08	26.28417	01 16	44.88	+12 14	27.2
/1981i	1981 09	25.31454	01 08	48.62	+13 54	56.9
/1981j	1981 07	11.28627	22 40	08.05	-07 38	49.3
/1981j	1981 07	31.26675	22 43	50.46	-04 41	57.5
/1981j	1981 08	01.23275	22 43	44.48	-04 33	17.4
/1981j	1981 08	02.28005	22 43	35.89	-04 23	51.7



/1981J	1981 08 26.19737	22 31 35.06	-00 43 42.8
/1981J	1981 09 25.20950	22 05 03.25	+03 53 57.4
/1981K	1981 09 05.23556	00 33 08.82	-08 08 54.2
/1981K	1981 09 07.20690	00 31 39.18	-08 18 41.6
/1981K	1981 09 29.21800	00 12 22.75	-09 40 47.6
50	1981 05 09.17860	14 37 26.56	-12 04 24.6
431	1981 02 01.03595	04 04 01.19	+19 25 49.3
574	1978 04 09.26742	13 10 03.66	-14 16 33.4
682	1981 01 31.15561	07 44 27.13	+05 27 17.9
682	1981 03 04.08711	07 26 55.69	+08 17 17.9
863	1981 06 30.09733	13 50 48.36	+18 54 44.7
1162	1981 08 27.30468	00 01 47.87	-01 46 24.9
1176	1978 09 29.15343	22 03 00.95	-01 39 32.5
1187	1980 09 19.16414	22 17 03.82	-04 48 59.4
1537	1981 02 28.34109	14 16 21.35	-15 41 46.1
1537	1981 03 04.38977	14 15 41.94	-15 38 25.0
1737	1981 09 21.18681	22 50 07.31	-02 16 10.6
1758	1978 04 07.07005	07 54 51.64	+25 23 36.7
1824	1981 04 01.15139	11 33 05.98	+03 48 01.9
1911	1981 09 29.35088	03 05 33.24	+19 26 13.0
1971	1981 09 25.26448	00 36 27.29	+17 27 28.9
2047	1978 04 10.35161	15 56 57.34	-24 50 48.1
2060	1981 08 29.32840	03 22 39.14	+16 00 36.1
2060	1981 09 05.30634	03 22 32.36	+15 58 28.2
2086	1981 03 04.04131	07 23 50.71	+31 51 48.7
2100	1981 09 05.13128	20 40 12.51	+03 16 15.4
2115	1978 04 15.29436	14 14 26.25	-20 21 04.0
2221	1980 09 12.10090	21 31 41.64	+10 45 27.6
2228	1981 05 09.17860	14 37 13.04	-12 29 43.9
2274	1978 09 28.31733	02 50 53.99	+18 43 10.5
2304	1980 09 09.26564	02 00 55.65	+11 50 54.1
2306	1980 09 09.29123	02 07 16.61	+16 51 13.0
2307	1979 06 01.16385	17 30 03.03	-21 51 49.5
2307	1980 09 04.23553	23 10 31.22	+06 57 54.5
2311	1980 09 09.12833	22 01 17.14	-11 21 13.0
2314	1977 11 12.12332	03 01 33.32	+19 53 41.6
2326	1980 12 11.14704	03 18 53.80	-05 58 22.2
2331	1980 12 04.15142	02 50 57.50	+18 31 30.3
2332	1980 12 04.07169	02 32 49.86	+10 23 01.7
2347	1981 02 06.12397	05 51 58.12	+25 48 31.0
2349	1981 02 10.00657	03 54 44.82	+03 58 01.8
2352	1980 09 04.31247	00 21 53.20	+20 59 57.6
2353	1980 12 04.18804	03 27 23.64	+23 17 01.0
2370	1981 03 04.04131	07 23 40.19	+31 51 53.5
2374	1981 01 31.08265	03 48 22.84	+38 56 50.2
2377	1981 05 09.11105	12 00 52.64	-01 28 02.2
2385	1981 04 08.17744	10 30 37.74	+11 17 31.1
2386	1981 02 06.19108	07 43 23.85	+33 03 59.0
2386	1981 03 27.07428	07 30 10.88	+30 41 46.7
2387	1981 05 09.17860	14 36 47.41	-12 20 40.3
2394	1981 03 12.24079	10 24 45.67	+11 15 26.9
2400	1981 03 11.16123	09 30 14.92	+09 06 56.8
2400	1981 04 07.16322	09 22 22.18	+11 15 54.5
2400	1981 05 03.11329	09 28 41.37	+12 04 36.7
2409	1981 03 02.23061	10 37 19.68	+10 34 01.7
2409	1981 04 08.12005	10 11 01.76	+13 29 58.6
2423	1981 04 08.26751	12 29 58.81	-09 54 05.5
2425	1981 05 09.20029	14 48 48.43	-14 04 19.0
2425	1981 05 24.20512	14 35 58.25	-14 02 17.2
2426	1981 06 01.22738	15 41 38.70	-18 19 21.1
2426	1981 06 27.16848	15 28 23.06	-16 12 14.2

2426	1981 06	28.16069	15 28	11.11	-16 08	57.6
2427	1981 01	03.01091	00 50	37.12	+06 07	56.0
2430	1977 11	12.12332	03 01	36.39	+20 10	57.2
2431	1981 04	08.08463	09 55	38.16	+11 45	23.0
2435	1980 12	05.28676	06 08	20.73	+16 30	22.1
2436	1981 06	30.22359	17 38	35.22	-19 55	10.5
2441	1981 01	31.18801	07 50	31.63	+19 07	32.0
2444	1981 07	09.17797	19 24	30.67	-20 56	42.5
2444	1981 08	03.13738	19 01	02.97	-19 53	55.4
2447	1981 07	09.21656	22 02	28.60	-07 12	43.2
2447	1981 08	27.22229	21 45	01.57	-14 21	06.5
2447	1981 09	21.14102	21 35	50.19	-18 13	21.5
2448	1981 06	05.26750	20 37	42.32	-10 01	26.0
2448	1981 06	27.27877	20 31	28.85	-11 37	32.5
2448	1981 08	02.19407	20 04	10.00	-16 24	37.7
2449	1980 02	12.03728	04 44	35.78	-09 42	12.0
2449	1981 05	09.32641	19 00	47.17	+21 00	18.9
2449	1981 06	01.32862	19 13	03.22	+29 17	58.8
2449	1981 07	28.11292	18 45	20.55	+28 36	24.5
2449	1981 07	28.16424	18 45	19.34	+28 35	15.8
2449	1981 08	22.11256	18 48	02.68	+17 02	48.1
2453	1981 02	28.03038	07 55	37.20	+33 21	29.8
2453	1981 03	27.11177	07 53	09.33	+31 34	07.4
2454	1981 06	02.16638	14 35	25.22	-17 05	14.7
2454	1981 07	01.12148	14 29	11.71	-15 05	06.3
2457	1980 12	04.29899	06 02	50.47	+15 29	07.9
2457	1981 01	03.24133	05 34	27.41	+15 57	30.1
2458	1981 06	28.13429	14 02	45.72	-09 48	11.3
2458	1981 06	29.09354	14 02	54.21	-09 49	48.7
2459	1981 06	27.24649	21 56	13.86	+01 16	08.2
2459	1981 09	29.12567	21 38	13.43	-02 04	59.2
2462	1981 04	03.34142	13 08	35.84	-01 15	41.5
2462	1981 05	08.21525	12 43	38.01	+00 33	35.5
2462	1981 06	05.14956	12 45	22.78	-00 43	44.8
2463	1981 05	09.22970	16 19	02.75	-03 49	10.9
2463	1981 05	24.22823	16 06	32.50	-02 33	31.9
2468	1980 12	04.24339	05 05	46.39	+16 52	36.2
2468	1981 01	03.13788	04 37	09.58	+15 39	49.7
2468	1981 02	04.11862	04 31	51.10	+15 56	35.2
2469	1981 04	07.33302	15 30	27.86	-05 52	11.9
2469	1981 05	04.25646	15 15	16.51	-03 27	01.2
2469	1981 06	01.18263	14 55	28.83	-02 06	31.1
2469	1981 06	24.13610	14 47	02.37	-02 33	26.3
2470	1981 09	29.31601	02 35	34.30	+11 36	07.9
2475	1981 06	24.20721	16 40	41.00	-12 34	57.7
2475	1981 06	28.21481	16 38	02.40	-12 29	03.8
2476	1981 04	03.36494	14 07	37.30	+00 53	30.9
2476	1981 05	04.22894	13 44	04.80	+02 21	23.9
2476	1981 05	08.24899	13 41	13.00	+02 24	55.1
2477	1981 06	29.27005	21 50	43.67	-03 07	26.4
2477	1981 06	30.25499	21 50	48.32	-03 03	54.9
2477	1981 08	03.19219	21 37	40.41	-03 10	55.1
2477	1981 09	05.15692	21 13	33.94	-06 27	50.7
2480	1981 04	03.31691	12 38	32.36	-01 58	30.2
2481	1981 08	27.30468	00 03	07.28	-01 55	49.8
2481	1981 09	25.23124	23 42	11.26	-03 15	33.3
2482	1981 05	09.25913	16 19	18.62	-18 16	17.2
2482	1981 05	25.24442	16 06	04.09	-17 49	23.3
2482	1981 06	27.19404	15 42	40.57	-17 12	46.7
2482	1981 07	01.18407	15 41	04.87	-17 12	34.2
2484	1981 05	09.15160	14 17	42.13	-13 11	41.1

2484		1981 06	30.09416	13 54	19.29	-10 56	31.8
2484		1981 07	01.09090	13 54	32.80	-10 57	47.0
2485		1981 08	29.29600	01 07	48.96	+02 59	00.1
2485		1981 09	30.29635	00 51	03.24	+00 48	21.0
2488		1981 01	31.39477	10 37	55.36	+20 05	55.9
2489		1981 08	27.32809	00 05	30.30	-02 03	17.6
2489		1981 09	30.21946	23 41	30.40	-04 31	08.2
2492		1981 02	01.37834	10 56	03.04	+07 43	02.0
2492		1981 02	28.22559	10 37	58.66	+09 31	05.2
2493		1981 05	03.28487	15 49	12.17	-13 55	30.0
2493		1981 05	25.21101	15 31	14.85	-11 56	57.9
2493		1981 06	24.14378	15 12	19.54	-10 14	35.5
2495		1981 08	27.06976	18 42	33.96	+13 26	46.1
2495		1981 09	30.02184	19 17	17.65	+02 59	26.0
1934	RR	1981 06	01.25441	15 49	54.25	-14 51	08.2
1940	GN	1981 01	03.16927	04 37	43.10	+22 39	25.4
1940	GN	1981 02	01.07307	04 26	27.16	+23 19	02.5
1943	EO	1981 09	29.26904	00 56	35.38	+04 34	02.9
1950	EL	1981 10	06.14380	01 23	18.77	+09 00	34.8
1950	FC	1981 09	25.26448	00 38	37.46	+17 55	16.8
1950	FC	1981 09	29.24147	00 35	01.06	+17 42	59.2
1964	TA1	1981 08	26.24687	22 56	50.12	-08 14	09.7
1964	TA1	1981 09	30.19208	22 29	42.36	-10 12	13.6
1964	TX1	1981 10	06.19060	02 14	32.14	+10 04	55.8
1964	TC2	1981 02	28.31201	12 27	08.84	-04 39	31.4
1964	VY	1981 10	04.14582	01 05	38.70	+04 49	04.7
1966	PD	1981 02	04.29931	08 33	19.22	+13 03	48.8
1966	PD	1981 03	04.12308	08 10	45.02	+14 10	39.4
1966	PD	1981 04	08.05059	08 14	17.19	+14 26	45.6
1968	SR	1980 12	05.33538	06 23	46.94	+24 23	50.2
1968	SR	1981 03	02.08132	05 43	52.82	+24 59	51.7
1972	ID1	1980 09	16.29543	02 09	00.14	-09 56	59.0
1972	LD1	1981 01	06.03317	01 24	09.33	-08 21	32.9
1973	SQ2	1981 01	09.14317	05 01	09.72	+26 53	19.6
1974	FG	1981 04	08.20609	11 53	46.73	-02 54	28.4
1974	FG	1981 05	02.15090	11 44	10.57	+00 07	40.5
1974	XX	1981 03	11.06397	07 54	25.17	+36 12	03.4
1974	XX	1981 03	27.04507	07 57	59.53	+35 39	59.0
1975	EE3	1981 08	26.09399	20 20	58.71	+09 21	39.9
1975	FE3	1981 09	25.09809	20 14	14.98	+00 10	39.7
1976	EC	1976 03	30.10308	09 10	26.93	+15 08	08.1
1976	GX2	1981 06	29.21024	18 12	12.71	-03 28	40.1
1976	GX2	1981 06	30.18634	16 11	20.92	-03 29	20.8
1976	GX2	1981 07	31.17748	17 52	04.46	-05 10	18.4
1976	GJ3	1981 03	04.32556	10 47	44.34	+30 37	57.4
1976	GJ3	1981 03	27.16806	10 29	08.99	+30 13	10.7
1976	GV	1981 02	05.99424	03 31	21.43	+21 23	51.5
1976	GG1	1981 09	29.19502	23 51	05.14	-01 55	19.3
1976	GG1	1981 09	30.24638	23 50	18.16	-02 01	01.5
1976	GG1	1981 10	01.12479	23 49	39.59	-02 05	48.4
1976	GG1	1981 10	06.08873	23 46	08.22	-02 31	41.6
1976	UB	1981 08	01.19222	21 31	57.18	-14 33	13.3
1976	UB	1981 08	08.16020	21 26	42.75	-14 58	30.5
1976	UP20	1981 08	26.13872	20 19	39.26	-13 02	35.7
1976	UP20	1981 09	29.08740	20 13	09.02	-15 34	47.6
1976	YX1	1981 09	29.29105	01 02	34.41	+06 42	30.2
1977	ET1	1981 06	27.13319	15 23	55.10	-09 51	05.0
1977	ET1	1981 06	28.18323	15 23	40.91	-09 51	24.1
1977	NR	1981 09	29.35088	03 06	38.87	+19 23	09.4
1977	PW1	1981 06	05.11723	14 35	30.44	-26 27	09.3
1977	PZ1	1981 08	08.24263	22 01	05.57	-08 47	12.8

1977 PZ1	1981 09 05.17968	21 36 53.45	-08 59 50.6
1977 FZ1	1981 09 30.11883	21 29 15.59	-08 57 02.9
1977 PZ1	1981 10 01.03473	21 29 21.62	-08 55 59.5
1977 QL2	1981 08 29.20304	23 08 14.20	+00 20 18.1
1977 QL2	1981 09 21.18681	22 56 17.55	-02 19 50.9
1977 GN3	1981 06 05.19550	15 46 22.45	-21 50 11.1
1977 RB	1981 03 04.25546	08 35 13.45	+35 29 21.3
1978 GR	1981 05 08.29656	16 09 11.54	+30 08 13.1
1978 GR	1981 06 02.22800	15 43 57.69	+31 29 18.6
1978 GR	1981 06 30.18692	15 27 28.43	+26 38 58.7
1978 NC3	1981 02 10.23436	09 01 47.56	+03 52 31.1
1978 NC3	1981 03 11.09564	08 44 20.44	+06 29 02.5
1978 PP2	1981 03 27.19007	11 08 00.32	+05 42 14.7
1978 PP2	1981 05 08.10488	10 56 34.38	+06 33 03.9
1978 PP2	1981 05 09.07552	10 56 46.46	+06 31 28.2
1978 PP3	1981 04 04.35720	12 35 35.49	-00 14 29.4
1978 RT	1981 01 31.29973	09 15 36.26	+23 48 47.4
1978 RT	1981 02 28.12461	08 53 43.06	+24 46 33.4
1978 RO1	1981 08 26.16584	22 18 56.46	-09 24 41.1
1978 SF	1981 08 02.24736	21 31 10.03	-15 47 55.8
1978 SP	1981 08 27.19841	21 10 28.03	-16 57 43.8
1978 SY2	1981 08 03.16564	20 31 25.35	-21 45 14.1
1978 VO5	1981 06 03.24657	16 19 56.29	-21 08 51.4
1978 VO5	1981 06 05.21773	16 18 15.64	-21 06 57.0
1978 VJ7	1981 06 03.19490	15 19 10.70	-17 28 00.5
1978 VJ7	1981 06 05.17434	15 17 53.78	-17 22 58.8
1978 DE	1981 08 27.27635	22 11 19.19	-20 24 59.3
1979 DE	1981 09 30.15444	21 50 33.57	-23 45 09.3
1979 DK	1981 08 29.22829	00 06 30.76	+12 20 43.0
1979 DK	1981 09 30.27400	23 42 00.54	+10 26 40.9
1979 MF4	1981 02 01.18963	06 37 16.14	+20 49 36.4
1979 MR4	1981 03 02.04743	04 50 18.33	+17 27 38.6
1979 MS8	1981 02 01.03595	04 03 16.78	+19 23 44.7
1979 OE	1981 02 10.04321	05 02 20.02	+23 39 52.0
1980 CF	1981 06 27.21822	16 39 30.72	-15 51 33.5
1980 EC	1981 09 05.08128	19 27 01.24	-12 00 26.3
1980 GC	1981 06 28.24024	16 54 16.50	+04 20 35.8
1980 GC	1981 08 02.16326	16 44 45.34	+02 39 36.9
1980 GC	1981 08 03.09977	16 44 41.63	+02 35 47.6
1980 KJ	1981 10 04.19418	01 08 52.62	+13 11 50.8
1980 KN	1981 10 01.08289	21 51 58.66	-16 11 20.3
1980 LA	1980 09 11.08640	19 19 26.49	+15 24 55.4
1980 LD	1981 10 04.16863	01 23 05.31	-08 47 52.5
1980 ES	1980 10 06.05731	20 26 40.41	-07 01 33.3
1980 PV	1981 10 06.22287	02 21 53.54	+26 35 44.7
1980 UA	1981 01 31.04821	02 06 13.41	+11 23 02.2
1980 VX	1981 02 04.03523	03 25 41.44	+18 36 09.1
1980 XA	1981 02 03.99255	03 38 18.09	+25 23 05.9
1981 BR *	1981 01 31.15561	07 44 43.24	+05 33 20.0
1981 CW	1981 06 03.09855	11 32 22.40	+10 21 24.6
1981 CC1 *	1981 02 01.29274	09 32 37.06	+16 45 08.3
1981 EB2 *	1981 03 04.35720	12 35 34.87	-00 29 07.5
1981 FD	1981 04 23.13961	12 05 12.51	-05 24 52.1
1981 FD	1981 05 08.17444	12 08 52.68	-01 26 07.9
1981 FD	1981 06 01.09735	12 26 32.84	-03 59 40.4
1981 FO	1981 04 01.15139	11 33 31.54	+03 08 12.0
1981 GK1 *	1981 04 03.31691	12 38 39.50	-02 03 51.9
1981 GL1 *	1981 04 07.33302	15 30 41.00	-06 04 24.3
1981 GM1 *	1981 04 01.15139	11 34 08.49	+03 40 42.4
1981 GN1 *	1981 04 01.15139	11 34 35.21	+03 31 03.2
1981 GO1 *	1981 04 01.15139	11 33 49.87	+03 47 20.3

1981 IM	*	1981 06 03.22119	15 45 49.33	-20 48 38.7
1981 PA		1981 07 31.26675	22 46 00.56	-04 40 53.8
1981 PA	*	1981 08 01.23275	22 45 13.22	-04 33 35.7
1981 PA		1981 08 02.28005	22 44 19.28	-04 25 41.3
1981 PA		1981 08 08.18714	22 38 33.56	-03 42 08.5
1981 PA		1981 08 22.13855	22 20 48.73	-02 06 43.7
1981 PA		1981 08 29.17697	22 10 22.61	-01 23 24.1
1981 PA		1981 09 25.14815	21 33 40.42	+00 51 40.7
1981 PF	*	1981 08 08.24263	22 01 33.36	-08 43 22.4
1981 PF		1981 08 29.14972	21 54 00.58	-15 14 48.0
1981 QA		1981 08 24.06192	20 20 20.20	+02 44 19.3
1981 QA		1981 08 24.17383	20 20 40.17	+02 40 45.2
1981 QA		1981 08 26.06258	20 26 55.09	+01 34 37.7
1981 QA		1981 08 27.12214	20 30 29.21	+01 51 57.3
1981 QA		1981 08 29.12097	20 37 23.42	-00 15 02.1
1981 QA		1981 09 07.16667	21 10 25.60	-05 38 34.6
1981 QA		1981 09 21.16608	22 01 50.85	-12 12 43.0
1981 QB		1981 09 05.10424	21 29 56.28	-19 57 44.1
1981 QB		1981 09 07.14476	21 27 37.58	-23 29 46.9
1981 GK1	*	1981 08 26.24687	22 57 26.10	-08 24 55.2
1981 GL1	*	1981 08 27.24649	21 56 01.20	+01 31 42.0
1981 RU	*	1981 09 05.26603	00 58 04.50	+09 57 34.8
1981 SB	*	1981 09 29.19502	23 51 31.77	-01 38 52.6
1981 SR		1981 09 30.24638	23 50 49.19	-01 48 31.4
1981 SE		1981 10 01.12479	23 50 14.78	-01 56 29.0
1981 SR		1981 10 06.08873	23 47 14.59	-02 38 56.4
1981 SC	*	1981 09 29.19502	23 52 32.77	-01 47 01.7
1981 SC		1981 09 30.24638	23 51 26.89	-01 47 28.6
1981 SC		1981 10 01.12479	23 50 31.99	-01 47 46.1
1981 SD	*	1981 09 30.24638	23 50 47.94	-01 46 16.4
1981 SD		1981 10 01.12479	23 50 08.91	-01 52 41.5
1981 SD		1981 10 06.08873	23 46 41.86	-02 27 02.2
1981 SE		1981 09 29.19502	23 52 12.12	-01 46 01.6
1981 SE	*	1981 09 30.24638	23 51 17.58	-01 52 36.7
1981 SE		1981 10 01.12479	23 50 32.84	-01 57 52.9
1981 SE		1981 10 06.08873	23 46 28.64	+02 26 58.2
1981 SU	*	1981 09 25.26448	00 38 48.68	+17 46 41.1
1981 SU		1981 09 29.24147	00 35 27.80	+17 37 15.7
1981 SV	*	1981 09 30.29635	00 51 39.61	+00 51 56.1
1981 TA	*	1981 10 01.12479	23 50 19.67	-02 08 52.4
1981 TR		1981 09 30.24638	23 51 49.41	-01 55 38.0
1981 TB	*	1981 10 01.12479	23 51 08.60	-01 59 22.0
1981 TC	*	1981 10 04.14582	01 04 06.67	+04 58 47.3
1981 TD	*	1981 10 04.14582	01 04 41.53	+04 47 41.1
1981 TE	*	1981 10 04.14582	01 05 20.24	+04 46 46.8
2605 P-L		1981 06 01.15447	13 28 44.24	-12 16 11.6
4021 P-L		1981 04 03.19637	11 32 56.20	+00 57 00.8
4579 P-L		1981 09 30.32431	00 59 48.33	+03 34 30.4

Table 2

Unmeasured observations

/1974 JI	1981 04 23
/1974 II	1981 05 03
/1974 II	1981 05 08
/1981t	1981 10 31
/1981h	1981 10 31
/19811	1981 10 31
883	1981 10 31
2100	1981 07 28
2475	1981 06 01
2480	1981 05 24
2480	1981 05 25
2495	1981 10 24
1974 FG	1981 05 23
1976 WR1	1981 10 25
1977 ET1	1981 06 02
1977 FA2	1981 10 31
1977 QR2	1981 10 31
1978 HJ5	1981 06 29
1978 VJ	1981 06 05
1979 DK	1981 10 25
1980 CK	1981 06 05
1980 CK	1981 06 28
1980 CK	1981 08 01
1980 CH	1981 10 25
1981 PA	1981 06 05
1981 PA	1981 10 29
1981 SB	1981 10 31
1981 UC	1981 10 25